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TOTAL ECLIPSE OF THE SUN,

ON AUGUST 18th, 1868,

PREPARED AT THE MADRAS OBSERVATORY

FOR THE

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by N. R. Pogson

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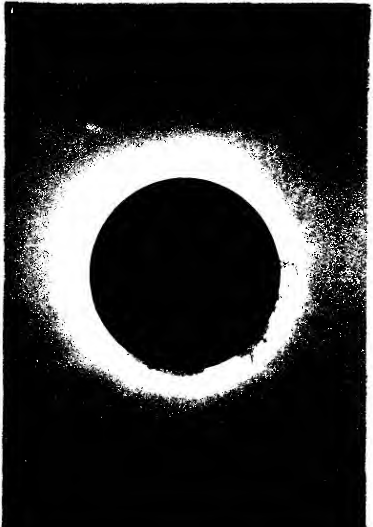
GENERAL PHENOMENA OF A TOTAL SOLAR ECLIPSE.



Lithog. at the Foster Press, Madras, 1867

THE TOTAL ECLIPSE OF THE SUN ON AUGUST 18th, 1868.

By N. R. POGSON, Esq., Government Astronomer at Madras.

On Tuesday morning, August 18th, 1868, an unusually favorable opportunity will be afforded to such residents in India as may feel inclined to avail themselves thereof, to behold the most magnificent and overwhelming celestial phenomenon conceivable, viz., a Total Eclipse of the Sun. Although such events are by no means rare, no less than nine occurring in various parts of the earth between the years 1860 and 1869, yet the space over which alone the phenomenon of total darkness can be witnessed is so limited, that it may be regarded as the event of a century or more for the inhabitants of any special locality to enjoy the privilege of beholding one within a reasonable or convenient distance from their ordinary abode. In Europe, so intense is the interest excited, not merely among those learned in the science of Astronomy but equally on the part of the intelligent public, that expeditions are equipped and long journeys willingly undertaken, by land or by sea, to obtain a sight of so sublime and impressive a scene. In three memorable cases, viz., in France and Italy, on the 7th July 1842; in Sweden and Norway, on July 28th, 1851; and in Spain, on July 18th, 1860, not only were official observers specially despatched by nearly every Government in Europe, to secure the important records demanded for the improvement of science, but hundreds of private individuals, from all parts of the continent, ranged themselves at various places near the line of central Eclipse, simply to enjoy and admire the grandeur of the scene; and though it is no longer as in ancient times a matter of superstitious awe and a source of ignorant groundless terror, it may well be conceived that it is impossible for the most imperturbable individuals, however well prepared by previous study and anticipation of what is to be expected upon such occasions, to look on without emotion and a life long-impression of the few brief minutes in which they have seen darkness overshadow the earth, the stars shine forth, and all nature hushed as in the silence of midnight. On the last of the three occasions named, the British Government placed a Steamer at the disposal of all who desired to visit Spain to witness the Eclipse; and the Spanish authorities, with equal liberality, welcomed and hospitably entertained their visitors during their stay. The scientific results of the expedition richly repaid the sacrifices and labor undertaken to secure them; and it is to be hoped that unfavorable weather will not deprive India of her forthcoming chance of rendering equal service to science. The following brief account of the phenomena usually seen, under favorable circumstances, during a Total Eclipse of the sun, will most probably be acceptable in anticipation of the grand event, which all who can should endeavour to see, and all who are fortunate enough to see will most certainly never forget.

The commencement of the Eclipse or first contact of the limbs will occur at the extreme upper edge of the sun's disc. Occasionally, though rarely, the Moon's limb has been faintly visible when nearly in contact with the sun, and it frequently happens that one or more minute indentations upon the Sun's disc precede the commencement of the Eclipse. These are of course due to lunar mountains, the elevated summits or peaks of which appear to notch the sun a second or two before the actual contact of the limbs. The progress of the eclipse for the first hour will offer nothing remarkable beyond the covering of any spots which may be visible, but about half an hour before the approach of totality the diminution of light and heat will be strikingly evident. The rapidly deepening gloom during the last quarter of an hour and especially just before the disappearance of the sun, is described as most awe inspiring and overwhelming by all who have witnessed the phenomenon, but observers will do well to keep themselves calm and collected for what is immediately to follow. From any lofty elevation it is possible to perceive the shadow majestically sweeping along the ground, but on a level tract of country the motion is far too rapid, and the observer's mind is usually too excited for anything of the kind to be seen. Terrestial objects appear to change color and exhibit successively yellow green and violet tints, while the faces of persons standing near assume a cadaverous aspect, as when illuminated by the well known ghostly flame of spirits of wine mixed with common salt. The sky appears to descend in the most awful manner, until the impression upon the mind is, that the waning sun has approached within a hundred yards or less of the wondering observer. Flowers close as upon the approach of night, but far more rapidly; animals usually show unmistakeable alarm; birds retire to roost, and bats and owls frequently flit about several minutes before the final disappearance, while a most oppressive stillness often prevails as the heat and light of the sun diminish. The grand event immediately follows—day is transformed into night, and the features hereafter to be described are disclosed to all who can sufficiently command their feelings to gaze calmly upon the solemn grandeur of the scene. The actual intensity of the total darkness is probably far less than is generally supposed, but the instantaneous extinction of sunshine does not allow the pupil of the eye time to dilate, and hence many persons find themselves unable to see the time by the white face of a watch or chronometer even when closely examined. An observer who had just issued from a dark room, or who had kept his eyes closed until the sun had actually vanished, would probably experience no such difficulty, and would doubtless see the phenomena of the totality far better than one who had watched the progress of the eclipse throughout. The brighter stars and planets will be readily visible as represented in the accompanying map. It will be interesting to note whether the Corona or halo of light surrounding the eclipsed sun, has sufficient intensity to cast visible shadows of objects upon the ground. The duration of total darkness along the line of central eclipse in India will vary from five to nearly six minutes; the greatest possible interval under any circumstances being nearly eight minutes. The re-appearance of the sun is unanimously described by all observers as far more sudden than the disappearance. It has frequently been greeted by a mighty shout of welcome by the thousands of awe-struck gazers whose pent-up feelings scarcely permitted more than half suppressed murmurs during the period of total darkness. The speedy unclosing of flowers, the general restoration of the ordinary appearances of nature, and the glow of light and heat immediately experienced, are points which cannot fail to excite the admiration of every beholder. The remainder of the eclipse, the gradual uncovering of the solar spots, and the last contact, will be watched with interest by all, but demand no further notice here. The phenomena of the Eclipse which require special description and explanation may be treated of under the four heads, Cusps, Baily's Beads, the Corona, and Red Prominences.

The Cusps.—The sharp point of the crescent sun, if well watched with moderate telescopic power, may occasionally be seen as if broken or slightly distorted, owing to prominent lunar mountains, which, as they successively sweep along the border of the sun's disc, produce minute irregularities, rarely visible however without optical aid. The rapid diminution of the solar crescent shortly before totality is very striking, and renders the measurement of the separation of the cusps by a sextant or other suitable instrument extremely difficult. The same remarks apply to their opening out after totality.

Baily's Beads.—Just before the commencement of totality, when the solar crescent has dwindled to a mere thread of light, its continuity is usually seen to be broken up and changed into a succession of more or less regularly distributed luminous drops or points, familiarly known as "*Baily's Beads,*" from their having been first described by Mr. Francis Baily, on the occasion of the annular eclipse of the sun in 1836. This appearance has been ascribed by some to the small irregularities caused by lunar mountains, but it is more generally regarded as a merely optical phenomenon, due to irradiation and defective definition of the telescope employed. In the total eclipse of July 28th, 1851, Mr. Hind and several other astronomers attributed it "to the existence of many mountains and valleys along the moon's edge, the sun's light shining through the valleys and between the mountain ridges so as to produce the appearance of luminous drops or beads which continued visible for some seconds." In such case the beads would have appeared steady, whereas other observers described them as waving, appearing and disappearing "like a device in gas swept over by a strong breeze," which could not have been the case if they owed their origin to lunar mountains agreably to the opinion above quoted. Mr. Warren DeLa Rue, who carefully watched for the beads in Spain, on July 18th, 1860, saw nothing of the kind, and evidently

RELATIVE POSITIONS OF THE PLANETS AND [illegible] TO THE NAKED EYE DURING THE TOTALITY OF THE SOLAR ECLIPSE OF AUGUST 18 [illegible]

C. Ragoonatha Charry, Del.

The centre of the Map represents the Zenith Point at the time of Totality

Lithog. at the Foster Press, Madras, [illegible]

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regards them as merely an optical illusion, due to the atmospheric disturbance of an image formed by a telescope wanting in perfect definition. They have however been so usually described by most observers, that whatever their cause, whether actual or merely illusory, they should be carefully looked for and will most probably be seen upon the occasion under consideration.

The Corona.—This is unquestionably the most striking and conspicuous feature of the eclipse. It appears a few seconds before the total extinction of the sun and is visible throughout the totality and for about the same interval after his reappearance. It consists of a radiant aureolo or *glory*, such as artists usually depict around the heads of saints or angels. Its breadth color and intensity have been so variously described, not only upon different occasions, but even by the most trustworthy and experienced observers when witnessing the same eclipse, that it is not safe to attempt any prediction on such points, or to expect uniformity in the accounts that may be afterwards given respecting them. The most brilliant portion undoubtedly lies within a quarter of the moon's diameter from her limb, but its full extent, fading off into invisibility, has been traced to a distance of nearly a whole diameter. The color has been variously stated as white, pale yellow, amber, lavender. peach and purple. The earliest well authenticated description of it was by Halley, during the eclipse of 1715, but the appearance was recorded even so far back as in the reign of the Roman Emperor Domitian. Again, while some describe the light as soft, silvery and steady. others have considered it violently agitated, flickering, and emitting vivid irregular rays or jets of light to a distance of several degrees from the moon's limb. In this, as in all other remarkable phenomena of brief duration, great allowances must necessarily be made for the very different temperaments of the observers, and the description given by a self possessed collected individual is infinitely more valuable and trustworthy than that of an excitable imaginative person.

The true nature of the Corona is still variously explained by different eminent authorities, but the generally received opinion is, that it is nothing more than the sun's outer luminous atmosphere seen around the moon's disc, when the actual photosphere or light emitting envelope is concealed from view by her opaque body; and that it would at all times be visible but for the overpowering effulgence of the great source of solar light and heat, which effectually obliterates it except under the rare and peculiar circumstances of a total solar eclipse.

The Red Prominences.—Admitting that the Corona is unquestionably the most striking and magnificent feature in a total eclipse, the Red Prominences, or as they have been frequently though perhaps less correctly described, the Rose Colored Flames are by far the most important and interesting in a scientific point of view. In appearance they resemble miniature mountains, of a rich rose-red tint, from about a thirtieth to a twelfth part of the sun's diameter in height, sometimes seen separate and at others in long sierra extending round a considerable portion of the eclipsed disc. Their shape is very varied and fantastic, for though usually resembling colored hills and mountain ranges, some have been described as hook-shaped—like a Turkish scimitar—as an Australian boomerang—and even as floating detached masses visibly separated from the sun's disc. That they belong strictly to the sun and not to the moon is clearly proved by the fact. that the latter body, in her passage across the sun's disc, uncovers and exposes to view those on the western side, while those on the eastern side are as visibly encroached upon and gradually covered by the advance of our satellite. Prominences on the north or south border of the sun remain unchanged, being merely grazed by the moon's limb. In no other phenomenon attending a total eclipse are experienced observers more unanimous than in their testimony as to this visible motion of the moon in regard to the prominences and their rich rose-red tint. Their actual nature is yet a mystery, but it seems pretty evident that they are material objects, of immense extent and height, connected with the sun, invariably seen with the smallest telescopic aid and frequently by the unassisted sight According to Mr. Hind they were first clearly described by Vassenius at Gothenburg during the total eclipse of May 3rd, 1733, but even at so remote a date as July 17th, 334, they appear to have been seen at Constantinople. by Julius Firmicus. The attention of astronomers was especially directed to these singular appendages in 1842, and at each subsequent total eclipse they have been regarded with the utmost consideration and most minutely and faithfully delineated. Accurate instrumental measurement of such brief phenomena appeared scarcely possible, but at the very favorable total eclipse of the sun in Spain on July 18th, 1860, when the duration of totality was nearly three and a half minutes, Mr. Warren De La Rue, who observed at Rivabellosa, near Miranda, in Spain, brought photography to the rescue, and with admirable tact, aided by the most elaborate instrumental appliances, succeeded in obtaining two pictures of the eclipsed sun, so perfectly as to admit of microscopic measurement of the originals, and of their enlargement in positive copies on glass, to the size of nine inches in diameter. The red prominences were not only distinctly recorded in these triumphant applications of the invaluable art of photography, and the progress of the moon as before named, uncovering on the one side and covering up the prominences on the other side in the direction of her motion, indisputably proved, but yet more was accomplished. A large dark prominence, actually invisible to telescopic observers, but possessed of a peculiar amount of actinic power, was recorded in each picture, and the general fixity of the prominences with regard to the sun was decisively established. This brilliant achievement in photographic astronomy formed the subject of an elaborate paper read before the Royal Society in April 1862; published as the Bakerian Lecture in the Philosophical Transactions of that year, and subsequently crowned by the award of a Royal Medal to its gifted and enterprising author.

On the occasion of the grand eclipse under consideration, of nearly six minutes duration, it will be a great pity if no adequate attempt is made to secure similar photographic records upon so extraordinarily favorable an opportunity. But there is yet another, and if possible a more wonderful work, awaiting the observers of the great eclipse in India. The recent application of spectrum analysis to astronomy, so successfully achieved by Mr. W. Huggins of London, by which we are actually informed as to the very materials of which the various celestial objects are composed,may possibly develop the nature of these prominences and decide whether they are solid or gaseous, and of what they principally consist. The brief interval of totality may be too short for the purpose but the attempt should be made. Already we know that certain metals exist in certain stars and planets; that nebulæ are gaseous and composed chiefly of nitrogen gas, and that one star differs from another in its actual substance as well as in its appearance and peculiar motions; but the dark body of the sun, surrounded as he is by his dazzling and resplendent photosphere, seems utterly beyond all hope of examination, and no chance of peering into the hidden mysteries of the formation of any of his appendages, such as that afforded by the analysis of the spectrum of these Red Prominences, should be lost.

The calculations of the eclipse for twelve important and conveniently accessible stations situated within the limits of totality, and of its partial phases at Madras, Calcutta, Bombay and Rangoon, have all been carefully made by C. Ragoonatha Charry, the Head Native Assistant at the Madras Observatory; and it is simple justice to add, that the very considerable labor he has bestowed upon them was undertaken from pure attachment to science and was accomplished solely in his leisure hours, without the slightest aid or advice from any one. The information afforded in his tabular results is all that can be required or desired for the prediction of the various phenomena of the eclipse. The first approximations, rarely differing from the final and more elaborate calculations by more than half a minute of time, were arrived at solely by means of an ordinary Slide Rule, the dexterous and judicious employment of which saves a vast amount of tedious and laborious computation. The times of first and last contacts for the six stations given only to the nearest minute were found by the approximate method, but for the rest by exact calculation, as also all the phenomena throughout which refer to the times of total phase. The moon's shadow enters the western coast of India near Viziadroog or Gheria with a breadth of 140 miles, and passing across the peninsula, a distance of 526 miles in about a quarter of an hour, leaves the eastern coast near Masulipatam, having at that moment a width of 146 miles.

The Table on page 8 exhibits the geographical positions of the central line and north and south limits of totality, for every successive five minutes of Greenwich mean time, and other interesting details of calculation. The principal places situated near the northern limit of the moon's shadow, and their direct distances therefrom in miles, are as follows:—

Dopalee	14 beyond.	Koolburga	20 within.
Satara	4 beyond.	Secunderabad	6 within.
Muswur	1 beyond.	Bhonagur	upon.
Punderpoor	2 beyond.	Kumummett	12 within.
Sholapoor (Terminus of the Bombay Railway)	2 beyond.	Rajahmundry	18 within.
		Cocanada	15 within.

Places similarly situated with respect to the southern limit of the moon's shadow are the following:—

Goa	6 beyond.	Adowani	7 within.
Belgaum	17 within.	Gooty	26 beyond.
Dharwar	9 beyond.	Nundial	4 within.
Guduk	10 beyond.	Cumbum	11 within.
Kanacgherry	upon.	Ongole	13 within.
Bellary	27 beyond.		

The vastly increased accuracy of the positions of the sun and moon, as given in the Nautical Almanac, since the adoption of Leverrier's Tables of the former and Hansen's Tables of the latter body, render these limits far more trustworthy than would have been the case had the older tabular positions been employed; but after all, the distances given by calculation may be slightly thrown out by the minute errors inseparable from the best theoretical positions. Places within the shadow will of course be favored with all the phenomena of totality, but only for a few brief seconds duration; exactly upon the limits, the corona, red prominences, and Baily's beads *may* be momentarily seen; but observers outside of the shadow can only witness a partial eclipse, shorn of all the wondrous appearances visible within the limits of totality; a slender crescent thread of the sun's disc still remaining visible at the time of greatest obscuration. The eclipse will be very considerable at Bombay, Madras and Rangoon, but much less so at Calcutta, and of course only partial at all four places. The particulars for these stations will be found on page 9. The geographical positions of all the sixteen stations for which special computations have been made are also given on page 12.

One or two hints to unprofessional observers, for whose benefit alone this description of the phenomena to be anticipated during totality has been written, will doubtless be acceptable in conclusion. Whatever telescope is employed should be firmly supported, and its dark glasses should *slip* easily, and on no account screw, on to the eye-piece. A few pieces of colored glass, of various shades, held in the hand before the eye-piece, are perhaps even more convenient; but the danger to the sight arising from an incautious look without such protection is too obvious to require any warning to the most inexperienced. By far the most comfortable and convenient mode of watching the progress of the eclipse with a telescope, before and after totality, is, to place a white card a short distance in front of the eye-piece, instantly removable when the totality approaches, and to receive thereupon the sun's image, which may be viewed with ease and safety by as many persons as can surround the telescope, instead of its being monopolized by a single individual. By sliding the eye-tube in or out until the sun's limb is seen sharply defined, the advance of the shadow and the successive covering of any solar spots may be watched, without distressing the eye and unfitting it for the infinitely more beautiful phenomena of totality. No dark glass will be needed during the total phase, but to appreciate the sublime scene to the best advantage, it will be advisable to refrain from fatiguing the eyes as much as possible during the earlier stages of the eclipse. A low magnifying power is best, and above all, the entire disc of the sun should be visible in the telescope at once, which cannot be the case when a high power is applied. The impressive grandeur of the terrestrial effects will however be far better realized by those who content themselves with simple slips of colored glass, green or neutral tint best, any color better than red, or at most with an opera glass, and who dispense with the use of a telescope altogether.

POSITIONS OF NORTH AND SOUTH LIMITS, CENTRAL LINE, DURATION OF TOTALITY, &c., FOR THE TOTAL ECLIPSE OF THE SUN, AUGUST 18, 1868.

Greenwich Mean Time.	North Limit.		Central Line.		South Limit.		On the Central Line.					
	North Latitude.	Longitude East of Greenwich.	Nort Latitude.	Longitude East of Greenwich.	North Latitude.	Longitude East of Greenwich.	Excess of the ☽'s apparent diameter above that of the ☉	Relative motion of ☽ in Orbit in one minute of time.	Sun's Altitude above the Horizon.	Inclination of the ☽'s apparent Orbit to the Equator.	Duration of Totality.	Breadth of the Moon's shadow on the Earth's surface.
h. m.	° ′	° ′	° ′	° ′	° ′	° ′	″	″	°	° ′	m. s.	Miles.
15 55	17 37	71 56	16 36	71 52	15 35	71 52	131·9	26·0	41	13 35	5 4·4	140
16 0	17 39	74 55	16 37	74 52	15 36	74 49	133·8	25·3	45	14 18	5 17·3	141
16 5	17 34	77 39	16 32	77 34	15 30	77 28	135·4	24·7	49	15 1	5 29·0	142
16 10	17 25	80 9	16 23	80 3	15 18	79 55	136·3	24·1	53	15 44	5 40·7	145
16 15	17 12	82 30	16 9	82 22	15 4	82 12	133·1	23·5	56	16 20	5 52·4	147
16 20	16 56	84 42	15 52	84 30	14 48	84 18	139·2	23·0	59	17 15	6 3·2	147

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LOCAL TIMES OF THE PHENOMENA OF THE ECLIPSE OF THE SUN, ON THE MORNING OF AUGUST 18, 1868, AT THE FOLLOWING PLACE,—BEYOND THE LIMITS OF TOTAL PHASE.

		Madras.	Calcutta.	Bombay.	Rangoon.
		h. m. s.	*h. m. s.*	*h. m. s.*	*h. m. s.*
Beginning of Eclipse		8 14 29	9 1 13	7 36 32	9 46 9
Time of greatest obscuration		9 32 35	10 20 13	8 47 39	11 13 34
End of Eclipse		11 0 37	11 45 15	10 8 39	12 43 50
Duration		2 46 8	2 44 2	2 32 7	2 57 41
Angle from North Point, at	Beginning	71° West	87° West	82° West	77° West
	Ending	102 East	124 East	110 East	121 East
Angle, from Vertex, at	Beginning	13 Left	16 Right	7 Right	2 Left
	Ending	170 Right	152 Left	175 Right	173 Right
Magnitude of the Eclipse (Sun's diameter = 1)		0·925	0·791	0·957	0·914
Limb of the Sun obscured		North	South	South	South

TIMES OF BEGINNING, ENDING, &c., OF THE TOTAL ECLIPSE OF THE SUN, ON THE MORNING OF AUGUST 18, 1868, AT THE FOLLOWING PLACES SITUATED WITHIN THE LIMITS OF TOTAL PHASE.

	MASULIPATAM.		GUNTOOR.		VINUKONDA.		DAVERKONDA.		HYDERABAD.		GHUNAPOORA.	
	Madras Time.	Local Time.	Madras Time.	Local Time.	Madras Time.	Local Time.	Madras Time.	Local Time.	Madras Time.	Local Time.	Madras Time.	Local Time.
Time of first contact................	8 15 10	8 18 59	8 14 10	8 15 9	8 13 —	8 11 —	8 12 —	8 7 —	8 11 55	8 5 1	8 11 —	8 3 —
Beginning of the total phase.......	9 30 36	9 34 25	9 29 5	9 30 4	9 27 54	9 26 7	9 26 1	9 20 58	9 26 0	9 19 6	9 24 19	9 15 48
Time of greatest obscuration......	9 33 29	9 37 18	9 31 56	9 32 55	9 30 35	9 28 48	9 28 44	9 28 41	9 27 38	9 20 44	9 27 4	9 18 31
Ending of the total phase..........	9 36 21	9 40 10	9 34 47	9 35 46	9 33 16	9 31 29	9 31 27	9 26 24	9 29 16	9 22 22	9 29 50	9 21 19
Time of last contact.................	11 1 17	11 5 6	10 59 17	11 0 16	10 58 —	10 56 —	10 55 —	10 50 —	10 53 14	10 46 20	10 53 —	10 44 —
	h. m. s.		*h. m. s.*		*h. m. s.*		*h. m. s.*		*h. m. s.*		*h. m. s.*	
Duration of the Eclipse.............	2 46 7		2 45 7		2 45 —		2 43 —		2 41 19		2 42 —	
Duration of totality..................	0 5 44		0 5 42		0 5 22		0 5 26		0 3 15		0 5 31	
Angle from North Point, of...... First contact..	76°	West	76°	West	78°	West	79°	West	78°	West	78°	West
Angle from North Point, of...... Last contact...	108	East	109	East	110	East	111	East	110	East	110	East
Angle from Vertex, of..... First contact..	4	Left	3	Left	2	Left	Vertex		Vertex		Vertex	
Angle from Vertex, of..... Last contact...	176	Right	175	Right	172	Right	173	Right	174	Right	173	Right
Distance of the Station from the central line in miles......	9	South	3	South	23	South	16	North	59	North	4	North

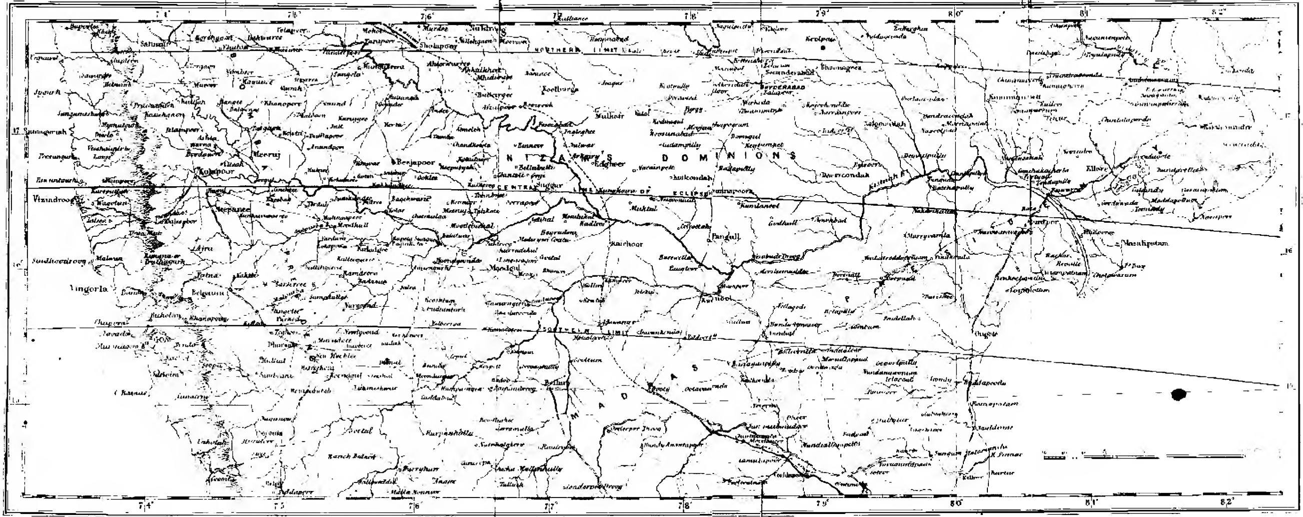
TIMES OF BEGINNING, ENDING, &c., OF THE TOTAL ECLIPSE OF THE SUN, ON THE MORNING OF AUGUST 18, 1868, AT THE FOLLOWING PLACES SITUATED WITHIN THE LIMITS OF TOTAL PHASE.

	KURNOOL.		MUKTULL.		SUGGUR.		BEEJAPOOR.		KOLAPOOR.		VIZIADROOG.	
	Madras Time.	Local Time.	Madras Time.	Local Time.	Madras Time.	Local Time.	Madras Time.	Local Time.	Madras Time.	Local Time.	Madras Time.	Local Time.
Time of first contact..................	8 11 10	8 2 34	8 10 55	8 0 10	8 10 —	7 56 —	8 8 45	7 50 54	8 7 —	7 43 —	8 6 —	7 39 —
Beginning of the total phase......	9 24 42	9 16 6	9 23 18	9 22 33	9 21 53	9 8 18	9 20 0	9 2 9	9 17 22	8 53 33	9 15 43	8 48 34
Time of greatest obscuration......	9 26 47	9 18 11	9 26 2	9 15 17	9 24 34	9 10 59	9 22 36	9 4 45	9 19 59	8 56 10	9 18 17	8 51 8
Ending of the total phase.........	9 28 52	9 20 16	9 28 46	9 18 1	9 27 16	9 13 41	9 25 12	9 7 21	9 22 36	8 58 47	9 20 51	8 53 42
Time of last contact................	10 53 11	11 44 35	10 51 23	10 40 38	10 49 —	10 36 —	10 46 35	10 28 44	10 43 —	10 19 —	10 41 —	10 14 —
Duration of the Eclipse............	*h. m. s.* 2 42 1		*h. m. s.* 2 40 28		*h. m. s.* 2 39 —		*h. m. s.* 2 37 50		*h. m. s.* 2 36 —		*h. m. s.* 2 35 —	
Duration of totality.................	0 4 10		0 5 29		0 5 23		0 5 13		0 5 15		0 5 8	
Angle from North Point, of........ First contact..	76°	West	77°	West	79°	West	79°	West	77°	West	78°	West
Angle from North Point, of........ Last contact...	107	East	107	East	109	East	109	East	106	East	105	East
Angle from Vertex, of .... First contact..	4	Left	2	Left	Vertex		1	Right	1	Left	Vertex	
Angle from Vertex, of .... Last contact...	174	Right	175	Right	173	Right	173	Right	174	Right	175	Right
Distance of the Station from the central line in miles ...	47	South	3	South	3	North	16	North	2	North	7	South

LATITUDES AND LONGITUDES USED IN THE CALCULATIONS OF THE TOTAL ECLIPSE OF SUN ON AUGUST 18, 1868, FOR THE UNDERMENTIONED PLACES.

	Names of Places.	Authorities for the assumed Positions.	North Latitude.			Longitude East from Greenwich.						Difference of Longitude in Time from Madras.	
						In Arc.			In Time.				
			°	′	″	°	′	″	h.	m.	s.	m.	s.
1	Madras (Observatory)	Madras Observatory Records	13	4	8	80	14	19	5	20	57·3		
2	Calcutta (Town)	Asylum Press Almanac, 1867	22	35	0	88	30	0	5	54	0·0	33	2·7 Fast.
3	Bombay (Observatory)	do. do.	18	53	30	72	48	34	4	51	14·3	29	43·0 Slow.
4	Rangoon (Town)	do. do.	16	49	0	96	13	0	6	24	52·0	63	54·7 Fast.
5	Hyderabad (City)	Trigonometrical Survey Asylum Press Almanac, 1842	17	21	41	78	30	54	5	14	3·6	6	53·7 Slow.
6	Kurnool (Laul Battery)	do. do.	15	49	58	78	5	22	5	12	21·5	8	35·8 Slow.
7	Masulipatam (Flag Staff)	do. do.	16	9	8	81	11	38	5	24	46·5	3	49·2 Fast.
8	Guntoor (Mosque)	do. do.	16	17	42	80	20	0	5	21	56·0	0	58·7 Fast.
9	Vinukonda (Town)	Pharoah's Atlas of Southern India	16	3	30	79	47	30	5	19	10·0	1	47·3 Slow.
10	Daverkonda (Town)	do. do.	16	42	0	78	58	30	5	15	54·0	5	3·3 Slow.
11	Ghunapoora (Town)	do. do.	16	34	0	78	6	30	5	12	26·0	8	31·3 Slow.
12	Muktull (Town)	do. do.	16	30	0	77	33	0	5	10	12·0	10	45·3 Slow.
13	Suggur (Town)	do. do.	16	37	30	76	50	30	5	7	22·0	13	35·3 Slow.
14	Beejapoor (Dome of the Sultan Mahomed's tomb)	Trigonometrical Survey Asylum Press Almanac, 1842	16	49	54	75	46	39	5	3	6·6	17	50·7 Slow.
15	Kolapoor (Town)	Johnston's Atlas	16	40	0	74	17	0	4	57	8·0	23	49·3 Slow.
16	Viziadroog or Gheria (Flag Staff)	Raper's Navigation	16	31	0	73	27	0	4	53	48·0	27	9·3 Slow.

PATH OF THE MOON'S SHADOW ACROSS INDIA DURING THE TOTAL ECLIPSE OF THE SUN ON AUGUST 18 1868



LITHO. AT THE ASYLUM PRESS MADRAS